create subscribers for certain types of events from the event subsystem. These events can form part of the input to the policy engine.

With reference to FIGURE 7A, one type of event handled by the policy engine is indicative of

5   the file system of a host having exceeded a threshold (FILESYSTEM_THRESHOLD_ EXCEEDED). That is, the ratio of the used space to the total capacity of a file system or logical drive has exceeded a defined threshold. A threshold subagent can raise such an event when the threshold has been exceeded. Upon receipt of such an event, an action handler, i.e., created by the policy engine based on (event, policy) pair, will determine whether or not to raise an alert.

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This decision can be made as follows:

      Step 1)

           Determine values for Monitor, Extend, Maximum file system size, Threshold, Alert Interval, and File System Extension Criteria by querying the policy

15   database. Start by filling in any specific file system settings, then up through Hosts and Host Groups. Anything not yet determined should be set to the Enterprise defaults (values not explicitly set will propagate up through the hierarchy).

      Step 2)

20   If Monitor value is no, exit.

Step 3)

Compare observed utilization (used space/capacity) as reported in the event to the defined threshold. If the observed utilization is not greater than the defined threshold, exit – no alert is raised and no LUN is assigned. Update the agent.

5   Step 4)

If this is not extendable file system go to step 5, else go to step 6.

Step 5)

Determine the amount of time, T, that has elapsed since an alert was raised for this condition and compare that to the alert interval stored in the policy database. If T is less than the alert interval, no alert is raised, otherwise indicate an alert should be raised and record the time it was done. Then exit.

Step 6)

If this file system has reached its maximum file system size send an alert, else go to step 7.

15   Step 7)

Attempt to extend the file system, as follows:

(i) Obtain the list of available LUNs matching the LUN type defined for the host from the SAN Disk Manager

20   (ii) If the list is empty, exit- no LUN is assigned, raise an alert and log that there are no LUNs of this type available.

(iii) Sort the list by size in descending order.

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(iv) Traverse the list until a LUN is found that is less than or equal to File System Extension upper bound but greater than or equal to File System Extension lower bound. If one is found, the selection process ends, and that LUN is used for assignment.

5   (v) If a LUN was not selected in step 7 (iv), and there are LUNs in the list that are smaller than File System Extension lower bound, select multiple LUNs from the list until the total capacity of the selected LUNs exceeds File System Extension lower bound, but is less than File System Extension upper bound if no combination of LUNs can be built to satisfy the LUN

10   Assignment Criteria (File System Extension lower bound < combined capacity of selected LUNs < File System Extension upper bound), the selection process ends, and no LUNs are assigned, and an alert is raised and logged.

Step 8)

15   Returns one or more LUNs to be assigned to the Storage Automation Service.

LUN Management

The SAN manager 20, as noted above, provides LUN management for the SAN 10. This

20 includes disambiguating logical unit identification information supplied by the agents (e.g., from inband discovery), assigning LUNs to hosts in manner consistent with policy defined by an administrator or otherwise (and effecting those assignments via the agents), deallocating LUNs, e.g., at operator/administrator request.

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